



## LANDSLIDE OCCURRENCES AND THEIR EFFECTS ON LAND USE ACTIVITIES IN KITTONY AREA OF ELGEYOMARAKWET COUNTY, KENYA

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### **Abstract:**

The main objective of this study was to investigate the occurrence of landslides and their effects on land use activities in Kittony area of Elgeyo Marakwet County, Kenya. The objective of the study was to: investigate the effects of landslides on land use activities in Kittony area of Elgeyo Marakwet County. The study population comprised of 2000 residents of Kittony Area in Elgeyo Marakwet County, five members of the local administration and a county geologist. The sample size consisted of the following respondents: Two hundred and forty six residents of Kittony area which translated to 12.3 % of the total population was selected as study respondents through Simple Random Sampling. One local chief of Kittony area and a County Geologist was purposively selected and interviewed. This study adopted a descriptive survey research design and utilized a qualitative research methodology. The systems theory was used to underpin the study and a conceptual framework showing the interrelationship between the dependent and independent variables was used to guide and conceptualize the study. The finding of this study was that the frequent occurrences of landslides in the area had affected farming activities, led to loss of property and lives. That the government despite assisting by providing humanitarian assistance and advising people to move to safer locations, more was needed in terms of relocating residents to safer areas and converting the affected areas into forest lands, building gabions to control soil erosion and controlling other human activities. This study could also be replicated in other areas having similar problems.

**Keywords:** landslide occurrences, landslide effects, land use activities

### **1. Introduction**

All studies discussed in this review demonstrate increased sedimentation after the arrival of European settlers and farmers in New Zealand. However, climate variability

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can also influence sedimentation rates. As Eden and Page (1998) pointed out, some Holocene erosion periods for the Lake Tutira region (Page and Trustrum, 1997) are not represented in the nationwide sequence of distinct and synchronous periods of increased sedimentation recognized by Grant (1985, 1989, 1994) and McFadgen (1985, 1989, 1994). Eden and Page (1998) argue that this is because the fine resolution of the local Lake Tutira chronology shows shorter erosion periods over the last approximately 2250 years than the more coarsely resolved chronologies based on geographically widespread data extending back to the Taupo Tephra (1718 cal. years BP). Nevertheless, all chronologies attribute increased erosion in headwaters to climatic episodes such as increased frequency of tropical and extra tropical cyclonic storms. Under native forest, bracken, fern and scrub, landslides were not so common because of protection by the dense native vegetation cover. This is supported by the early investigations of O'Loughlin (1984), which demonstrated enhanced slope stability through the mechanical reinforcement provided by tree root systems. Similar findings were documented by Phillips and Watson (1994), and are supported by observations of different landslide density in areas of different vegetation cover areas following two distinct rainstorm events (Phillips et al., 1990).

Various contributing authors have stressed the link between climatic and human impacts on landslide initiation. Examples for the Holocene were given for Germany (Grunert and Hardenbicker, 1997), Scotland (Innes, 1997), Great Britain (Ibsen and Brunsden, 1997) and Italy (Rodolfi, 1997).

Another socioeconomic impact of landslides is the destruction of property and agricultural land. It is estimated that over 100,000 US dollars worth of property including houses, coffee and tea plantations and domestic animals were destroyed by landslides between 1980-1997 in Muranga District alone (Ngecu and Mathu 1999). This was in addition to mobilization of several million cubic meters of agricultural land from the original location to hundreds of meters down slope (Ngecu and Mathu 1999).

In Kenya, More than 50,000 people in three areas of Kittony, Embobut and Kakisoo areas in Elgeyo-Marakwet County were warned to relocate from their homes to safer grounds due to possible landslides following heavy rains that pounded the area (Bii, 2014). In the year 2011, landslides hit Kittony area killing 15 people and injuring several others (Bii, 2014).

Landslides destroyed farmland, farm crops and livestock as they got covered with rubble comprised of huge stones. That resulted in food shortages and increased food prices. The community members in the affected parish feared that because of the landslide, there were threats of famine in future. Agriculture was one of the main economic activities and source of livelihood for people in Bududa. Therefore, a reduction in the harvest as a result of destruction of farmland could greatly affect the returns for farmers as well as the quality of their life. Many community members also lost their livestock like cattle, goats, pigs and chickens which were all buried by the landslide. The livestock were always sold by households to solve their financial problems such as medical care. Given that, agriculture is the mainstay for households

around the Mount Elgon region, the destruction of farms and farmland by landslides places people in this region at the risk of famine. Mutuna, (2010:1) reported that landslides had displaced more than 300 people in Kisinga sub county in Kasese district of Western Uganda. No death or injuries were realized, but numerous fields of crops and livestock were destroyed by falling mud. He further stated that over 340 acres of coffee plantations were destroyed by landslides in Bulambuli in 2011. It was estimated that coffee production went down by 40 metric tonnes resulting in a predicted 10% decline in output for the years 2011/2012. This equally translates to loss in foreign exchange earnings for the country.

Socioeconomic impacts of landslides. There has not been any recorded effort to estimate the economic loss of landslides in Kenya despite the high frequency of the occurrence of the landslides. However, economic losses due to landslides can be classified as direct and indirect (Ngecu and Ichang'i, 1999; Ngecu and Mathu, 1999; Schuster and Highland, 2001). Direct costs can be defined as the costs of replacement, rebuilding, repair, or maintenance resulting from direct landslide-caused damage or destruction to property or installations. All other costs of landslides are indirect; examples are the following: Reduced real estate values in areas threatened by landslides, Loss of tax revenues on properties devalued as a result of landslides, Loss of industrial, agricultural, and forest productivity and of tourist revenues, as a result of damage to land or facilities or interruption of transportation systems (Knapen et al., 2006). Loss of human or domestic animal productivity because of death, injury, or psychological trauma (Kitutu et al., 2009).

## **2. Statement of the problem**

Landslide occurrence as a consequence to land use changes has been studied over various time periods. In the late Holocene, humans converted large areas from native forest and bush into arable land in various areas throughout Europe. Increased activity of geomorphic processes resulted, including Aeolian transport and flooding, accelerated sheet and rill erosion, open and tunnel gullying and landsliding. For Europe and other regions, Matthews et al. (1997) reviewed rapid mass movements as a source of palaeoclimatic evidence for the Holocene.

In Kenya, More than 50,000 people in three areas of Kittony, Embobut and Kakisoo in Elgeyo Marakwet County were warned to relocate from their homes to safer grounds due to possible landslides following heavy rains that pounded the area (Bii, 2014). In the year 2011, landslides hit Kittony area killing 15 people and injuring several others (Bii, 2014).

The government therefore needs to come up with a permanent solution by settling the families in safer areas since the current location has proved inhabitable due to landslides. A team of geologists who toured the place following the tragedy declared the area as unfit for human settlement. The area is prone to landslides due to the steep topography and loose soil making it inhabitable (Mulama, in Bii, 2014)



order to answer questions concerning current status of the subject in the study. Surveys can be used for explaining or exploring the existing status of two or more variables at a given point in time. The design enables the researcher to have a wider coverage and comprehensive description of the observed characteristics and interrelationship in the target population (Creswell & Miller, 2005).

Descriptive survey design enables the researcher to collect original data for the purposes of describing and measuring the characteristics of a population, which is too large to be observed directly. The design was selected because it is very convenient in collecting substantial amount of views from respondents over a wide area using limited resources (Kombo and Tromp, 2006).

Therefore, the variables that were studied were at their natural occurrence and not manipulated by the researcher. The survey method was appropriate because it is a self-report study, which required the collection of quantifiable information from the sample. This involved collection of both quantitative and qualitative data. This study was concerned with the investigation on the occurrence of landslides and their effect on land use activities in Kittony Area of Elgeyo Marakwet County.

### **3.1 Study area**

The study was conducted in Kittony Area of Elgeyo Marakwet County. Elgeyo Marakwet County is located in Rift Valley Province and constitutes 4 constituencies; Marakwet East, Marakwet West, Keiyo North, and Keiyo South. The county covers an area of 3,029.8 Sq Km with temperatures ranging between 14°C to 35°C. Rainfall ranges between 400mm and 1,400mm per annum. The administrative centre of the county is Iten town and is represented by 3 local authorities: County Councils of Marakwet and Keiyo, Town Council of Iten-Tambach. Economic activities in the county are characterized by mixed small scale farming and the keeping of cattle for both beef and dairy production. Crop production is mostly done in the highlands.

The county is most notable for its long-standing tradition of producing top athletes who

### **3.2 Target population**

Population refers to an entire group of individuals, events or objects having a common observable characteristic and a sample is a smaller group obtained from the accessible population ((Mugenda, 2008). The study population comprised of 2000 residents of Kittony Area in Elgeyo Marakwet County. Five members of the local administration, and one County Geologist.

### **3.3 Sample size and sampling procedures**

Orodho (2005) defines a sample as a set of respondents (people) selected from a large population for the purpose of a survey for a study. Sampling is the act, process or technique of selecting a suitable sample or a representative part of a population for the purpose of determining characteristics of the whole population (Kombo and Tromp,

2006). The sample size consisted of the following respondents: Two hundred and forty six residents of Kittony area which translates to 12.3 % of the total population was selected as study respondents through Simple Random Sampling. One local chief of Kittony area and a County Geologist were purposively selected and interviewed. The local chief and a County Geologist were purposively selected because being local administrators who are constantly in touch with the people and link them to the county government they are better placed to respond to the issues affecting the local residents and the efforts the county government is making to address their problems.

### 3.4 Effects of landslides on land use activities

The objective of the study was to investigate the effects of landslides on land use activities in Kittony area. To achieve this objective, the respondents were asked to answer a number of questions that the researcher felt in its definition as consisting or related to this objective. These included; how farmers were affected by landslides, how landslides led to loss of property and lives and generally the residents were asked their opinion on how landslides had affected their socio-economic activities. Table 1 shows the findings.

**Table 1: Effects of Landslides on Socio-Economic Activities**

Item	Agreed		Undecided		Disagreed		Total	
	F	%	F	%	F	%	F	%
Farming is affected by regular movement to safer locations	201	81.7	45	18.3	0	0	246	100
Landslides lead to loss of property and lives	207	84.1	39	15.9	0	0	246	100

When the residents of the area were asked whether farming was affected by regular movements to safer locations, a majority 201(81.7%) agreed that indeed farming activities are affected by annual movements to suffer locations especially during the rainy season when landslides occur, none disagreed, while only 45(18.3%) were undecided on the issue. The majority who said that the farming activities were destructed during landslides agree with the views of Ngecu and Mathu 1999 and Mutuna 2010:1) who concur that human and economic activity of the people, are greatly affected by landslides due to their perennial movement from one place to another during landslide occurrences.

Asked whether landslides led to loss of lives and property, a majority 207(84.1%) agreed with the statement, none disagreed, while 39(15.9%) were undecided on the issue. The many residents who agreed that landslides lead to loss of property and lives agreed with views of (Bii 2014, Ngechu and Mathu 1999, Mutuna 2010:1, Kitutu et. al. 2009, Knapen et. al. 2006, Real Plan Consultants 2012 and Kipkorir 1973) who argue that the frequent landslides witnessed in the area had greatly lead to massive loss of property and lives. Bii further argues that about 200 people lost their lives and a lot of property was destroyed when landslides buried alive an entire village in the area in 2011.



When the residents of Kittony were asked about their honest opinion on how the annual landslides had affected the activities, their responses are recorded in Table 2.

**Table 2:** Effects of Landslides on Socio-Economic Activities

Item	Agreed	
	F	%
No longer do farming, no permanent asset because they are destroyed annually	125	50.8
Pieces of land have been reduced by landslides	113	45.9
Other	8	3.3
Total	246	100

Table 2 indicates that slightly above a half of the residents of Kittony area 125 (50.8%) were of the opinion that landslides had affected their farming activities and construction of permanent structures in the area. This is because these activities together with permanent structures have no guarantee of remaining for many years due to constant landslides that are prone in the area. Many residents also 113(45.9) agreed that their pieces of land had been drastically reduced by landslides. This agrees with the views of Mutuna, (2010) that among other things, landslides also affected the size of land. Eight (3.3%) of the residents also mentioned other effects or were undecided on the issue.



**Figure 2:** House destroyed by huge rock boulders down a slope due to a landslide.



**Figure 3:** Uprooted plants and trees by a landslide

### **3.5 Effects of landslides on land use activities**

A majority of the residents indeed agreed that their farming activities were affected by their annual movements to safer locations. This agrees with the views of Ngecu and Mathu (1999), that social and economic activities of the people are greatly affected by landslides due to the constant movement of people from one location to another during landslide occurrences.

Majority also accepted that landslides lead to loss of lives and property. This agreed with the views of Bii, (2014) who argues that the frequent landslides witnessed in the areas had greatly led to massive loss of property and lives.

When the residents were asked their opinion on how the annual landslides had affected their activities, a majority indicated that they no longer carry out farming nor have permanent structures and assets because they are destroyed annually by landslides, followed by those who indicated that pieces of land have been reduced by landslides.

## **4. Conclusions**

The frequent occurrences of landslides in the area had affected farming activities, led to loss of property and lives. It also affected the residents in that they could not set up permanent structures in the area for fear of destruction during landslides and that



pieces of land had been greatly reduced by landslides. That the government despite assisting by providing humanitarian assistance during landslide occurrence and advising people to move to safer locations more was needed in terms of relocating residents to safer areas and converting the affected areas into forest lands. Improving the drainage of the area, building gabions to control soil erosion and controlling other human activities such as quarrying were suggested as measures to curb the effects.

#### **4.1 Recommendations**

1. Deforestation, settlement, infrastructure development, rapid population growth and urbanization are some of the human activities contributing to increased incidence of landslides.
2. This research has demonstrated the consequence of a non-intervention policy to peoples search for livelihood. There is however, opportunity for the national and especially county governments in regions prone to landslides to now put in place comprehensive landslide disaster mitigation policies, laws, regulations and institutions. County governments in landslide prone counties should put in place programmes and action plans with requisite budgets and institutions to the lowest level of administration.
3. It also calls for permanent personnel who are able to respond quickly. They should stock emergency disaster relief supplies, tools and equipment that can be rapidly deployed to save lives when this disaster strikes as suddenly as it does.
4. Policy recommendations on landslides for adoption by government should reflect worldwide best practices. Japan, New Zealand and Australia have implemented some of the most effective and stringent landslide policies and a lot can be learned from these countries.
5. The Kenya government should seek collaborative research partnership with these countries by seeking technical assistance to undertake landslide risk mapping and developing safe best practice environmental planning measures to adopt towards minimizing losses to life and property arising from landslides.
6. The researcher recommends that policies should be developed in landslides prone areas in the protection of lives and livelihoods in Kenya.
7. Government should convert the affected areas to forest lands. This will work on the soil structure in the area and will become compact.
8. Drainage in the area should be improved, gabions built to control soil erosion and other human activities such as quarrying should be discontinued.

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